

WHAT IS CLAIMED AS NEW AND IS DESIRED TO BE SECURED BY LETTER
PATENT OF THE UNITED STATES IS:

1. An image forming and binding system for producing a booklet of a document file, comprising:

an image forming apparatus including a sheet feeding device configured to feed a full-size sheet set to be conveyed in its longitudinal direction and a half-size sheet half a size of the full-size sheet and set to be conveyed in its lateral direction, and configured to form images on both sides of the full-size sheet or the half-size sheet fed by the sheet feeding device and to discharge the sheet;

an image formation controller connected with the image forming apparatus and configured to control the image forming apparatus to form images of the document file on both sides of the full-size sheet and the half-size sheet fed by the sheet feeding device one by one, the image formation controller controlling the image forming apparatus to form images of four pages of the document file on each full-size sheet fed by the sheet feeding device such that images of two pages of the four pages are on each side of the full-size sheet and images of two pages of the document file on each half-size sheet fed by the sheet feeding device such that an image of one page of the two pages is on each side of the half-size sheet; and

a sheet folding and binding apparatus including,

a sheet receiving device configured to receive the sheet discharged from the image forming apparatus and to further convey the received sheet, the sheet receiving device including

a sheet size detect device configured to detect if the received sheet is the full-size sheet conveyed in its longitudinal direction or the half-size sheet conveyed in its lateral direction,

a folding device configured to fold the received sheet conveyed by the sheet receiving device in two at its center portion in a direction the received sheet is conveyed by the sheet receiving device, when the received sheet has been detected by the sheet size detect device to be the full-size sheet conveyed in its longitudinal direction, and to further convey the folded received sheet with the folded center portion thereof being served as a leading edge of the folded received sheet, the folding device conveying the received sheet conveyed by the sheet receiving device without folding the received sheet, when the received sheet has been detected by the sheet size detect device to be the half-size sheet conveyed in its lateral direction,

a jogging device configured to receive and jog the received sheet conveyed by the folding device, one after another, so as to be stacked one upon another; and

a binding device configured to bind the stacked received sheets at their leading edge portions in a direction the received sheets have been conveyed by the folding device and to discharge the bound stacked sheets as the booklet.

2. The image forming and binding system according to Claim 1,

wherein the sheet feeding device of the image forming apparatus is configured to feed a plurality of full-size sheets different in sizes and set to be conveyed in their longitudinal directions and a plurality of half-size sheets respectively half sizes of the plurality of full-size sheets and set to be conveyed in their lateral directions,

wherein the image formation controller is configured to designate one of the plurality of full-size sheets as the full-size sheet for forming the images of four pages of the document file thereupon,

wherein the sheet size detect device of the sheet receiving device of the sheet folding and binding apparatus is configured to detect a size of the received sheet,

wherein the folding device of the sheet folding and binding apparatus includes a guiding mechanism configured to receive, guide and stop the received sheet conveyed by the sheet receiving device at a predetermined position according to the size of the received sheet detected by the sheet size detect device, when the received sheet has been detected by the sheet size detect device to be the full-size sheet conveyed in its longitudinal direction, and a sheet pushing mechanism configured to push the received sheet guided and stopped by the guiding mechanism downward at its center portion in the direction the received sheet is conveyed by the sheet receiving device, and a sheet folding/pressing device configured to pinch the received sheet at the center portion thereof pushed by the sheet pushing mechanism so that the received sheet is folded

at the center portion thereof by the sheet folding/pressing device and the folded received sheet is further conveyed with the folded center portion thereof being served as the leading edge of the folded received sheet, the sheet pushing mechanism guiding the received sheet conveyed by the sheet receiving device, when the received sheet has been detected by the sheet size detect device to be the half-size sheet conveyed in its lateral direction, so as to be further conveyed by the sheet folding/pressing device without being folded by the sheet folding/pressing device, and

wherein the jogging device is configured to receive and jog the received sheet conveyed by the folding device, one after another, at a predetermined position in the jogging device according to the size of the received sheet detected by the sheet size detect device, so that the received sheet is stacked one upon another at the predetermined position.

3. The image forming and binding system according to Claim 2,

wherein the sheet receiving device of the sheet folding and binding apparatus includes a correcting mechanism configured to correct an advancing direction of the received sheet so as to be at a right angle relative to a longitudinal direction of the sheet folding/pressing device of the folding device.

4. The image forming and binding system according to Claim

3,

wherein the correcting mechanism of the sheet receiving device of the sheet folding and binding apparatus includes a reference guide configured to guide the advancing direction of the received sheet to be at the right angle relative to the longitudinal direction of the sheet folding/pressing device, and a sheet shifting device configured to shift the received sheet, while conveying the received sheet, to the reference guide so that the advancing direction of the received sheet is corrected by the reference guide so as to be at the right angle relative to the longitudinal direction of the sheet folding/pressing device.

5. The image forming and binding system according to Claim 1,

wherein the jogging device of the sheet folding and binding apparatus includes a movable device configured to move to a predetermined position to jog the received sheet conveyed by the folding device one after another with respect to left and right sides thereof in a direction the received sheet is conveyed by the folding device,

wherein the sheet folding and binding apparatus includes a controller configured to determine if the movable device has completed its movement to the predetermined position and to generate a signal indicating that the movable device has completed its movement to the predetermined position when determined as that the movable device has completed its movement

to the predetermined position, and

wherein the image formation controller is configured to control the image forming apparatus to start an image forming operation for a next sheet after receiving from the controller of the sheet folding and binding apparatus the signal indicating that the movable device of the jogging device has completed its movement to the predetermined position.

6. The image forming and binding system according to Claim 1,

wherein the sheet folding and binding apparatus further includes,

a detect sensor arranged between the folding device and the jogging device to detect passage of the received sheet, and

a controller configured to determine that the received sheet has been jammed and to generate a sheet jamming signal indicating that the received sheet has been jammed if detection of the passage of the received sheet by the detect sensor is not started within a predetermined period of time after a leading edge of the received sheet has been detected by the sheet size detect device of the sheet receiving device, or when the detection of the passage of the received sheet by the detect sensor has started, if the detection is not completed within a predetermined period of time after the detection has been started.

7. The image forming and binding system according to Claim 6,

wherein the image formation controller is configured to control the image forming apparatus, when controlling the image forming apparatus to perform an image forming operation after receiving from the controller of the sheet folding and binding apparatus the sheet jamming signal indicating that the received sheet has been jammed, to perform the image formation operation starting with images of pages of the document file formed immediately before.

8. The image forming and binding system according to Claim 1,

wherein the sheet folding and binding apparatus includes a controller configured to determine whether or not the folding device, the jogging device and the binding device are respective states ready for receiving a next sheet, and to generate a signal indicating that the folding device, the jogging device and the binding device are in the respective states ready for receiving the next sheet when determined as that the folding device, the jogging device and the binding device are in the respective states ready for receiving the next sheet, and a sheet jamming signal indicating that the received sheet has been jammed when determined as that the folding device, the jogging device and the binding device are not in the respective states ready for receiving the next sheet, and

wherein the image formation controller is configured to

control the image forming apparatus, when the image forming apparatus is in a state ready for starting an image forming operation, to start the image forming operation upon receiving from the controller of the sheet folding and binding apparatus the signal indicating that the folding device, the jogging device and the binding device are in the respective states ready for receiving the next sheet.

9. The image forming and binding system according to Claim 8,

wherein the image formation controller is configured to control the image forming apparatus, when controlling the image forming apparatus to perform an image forming operation after receiving from the controller of the sheet folding and binding apparatus the sheet jamming signal indicating that the received sheet has been jammed, to perform the image forming operation starting with images of pages of the document file formed immediately before.

10. The image forming and binding system according to Claim 1,

wherein the image formation controller is configured to control the image forming apparatus to form the images of the document file on both sides of the full-size sheet and the half-size sheet that are fed by the sheet feeding device one by one so as to be mixed with each other.

11. The image forming and binding system according to Claim 10,

wherein the image formation controller is configured to control the image forming apparatus to form images of given two pages of the document file on each of a given number of the half-size sheets fed by the sheet feeding device so as to be mixed with the full-size sheet.

12. The image forming and binding system according to Claim 1,

wherein the image formation controller is configured to set a direction of forming the images of four pages of the document file on each full-size sheet to be lateral and a direction of forming the images of two page of the document file on each half-size sheet to be vertical, and to set upper, bottom, left and right side margins to the half-size sheet and bottom, left and right side margins and a center margin to the full-size sheet.

13. The image forming and binding system according to Claim 1,

wherein the image formation controller is configured to control the image forming apparatus to form the images of four pages of the document file on each full-size sheet such that in order of forming the images at the image forming apparatus, an image of a fourth page of the four pages and an image of a first page of the four pages are on an upper side and an image

of a second page of the four pages and an image of a third page of the four pages are on a back side of the full-size sheet, and to form the images of two pages of the document file on each half-size sheet such that in order of image formation at the image forming apparatus an image of a first page of the two pages is on an upper side and an image of a second page of the two pages is on a back side of the half-size sheet.

14. A method of producing a booklet of a document file, comprising the steps of:

controlling an image forming apparatus including a sheet feeding device configured to feed a full-size sheet set to be conveyed in its longitudinal direction and a half-size sheet half a size of the full-size sheet and set to be conveyed in its lateral direction to form images of the document file on both sides of the full-size sheet or the half-size sheet fed by the sheet feeding device and to discharge the sheet by an image formation controller, the image formation controller controlling the image forming apparatus to form images of four pages of the document file on each full-size sheet fed by the sheet feeding device such that images of two pages of the four pages are on each side of the full-size sheet and images of two pages of the document file on each half-size sheet fed by the sheet feeding device such that an image of one page of the two pages is on each side of the half-size sheet;

receiving the sheet discharged from the image forming apparatus by a receiving device of a sheet folding and binding

apparatus, detecting if the received sheet is the full-size sheet conveyed in its longitudinal direction or the half-size sheet conveyed in its lateral direction by a sheet size detect device of the receiving device, and further conveying the received sheet by the receiving device;

folding the received sheet conveyed by the receiving device in two at its center portion in a direction the received sheet is conveyed by the receiving device by a folding device of the sheet folding and binding apparatus and further conveying the folded received sheet with the folded center portion thereof being served as a leading edge thereof by the folding device, when the received sheet has been detected to be the full-size sheet conveyed in its longitudinal direction in the receiving step, and conveying the received sheet conveyed by the receiving device by the folding device without folding the received sheet, when the received sheet has been detected to be the half-size sheet conveyed in its lateral direction in the receiving step;

receiving and jogging the received sheet conveyed by the folding device, one after another, by a jogging device of the sheet folding and binding apparatus, so to be stacked one upon another; and

binding the stacked received sheets by a binding device of the sheet folding and binding apparatus at their leading edge portions in a direction the received sheets have been conveyed by the folding device, and discharging the bound stacked sheets as the booklet.

15. The method according to Claim 14,

wherein the sheet feeding device of the image forming apparatus is configured to feed a plurality of full-size sheets different in sizes and set to be conveyed in their longitudinal directions and a plurality of half-size sheets respectively half sizes of the plurality of full-size sheets and set to be conveyed in their lateral directions,

wherein the controlling step includes designating one of the plurality of full-size sheets different in sizes and set to be conveyed in their longitudinal directions as the full-size sheet for forming the images of four pages of the document file thereupon,

wherein the receiving step includes detecting a size of the received sheet by the sheet size detect device,

wherein the folding step includes when the received sheet has been detected to be the full-size sheet in the receiving step, receiving, guiding and stopping the received sheet by a guiding mechanism of the folding device at a predetermined position according to the size of the received sheet detected in the receiving step, pushing by a pushing mechanism of the folding device the received sheet stopped by the guiding mechanism downward at its center portion in the direction the received sheet is conveyed by the receiving device, and pinching the received sheet by a sheet folding/pressing device of the folding device at the center portion thereof pushed by the pushing mechanism so that the received sheet is folded at the center portion thereof by the sheet folding/pressing device and

the folded received sheet is further conveyed with the folded center portion thereof being served as the leading edge of the folded received sheet, and when the received sheet has been detected to be the half-size sheet in the receiving step, guiding the received sheet by the pushing mechanism so as to be further conveyed by the sheet folding/pressing device without being folded by the sheet folding/pressing device, and

wherein in the receiving and jogging step the received sheet conveyed by the sheet folding/pressing device is received and jogged one after another by the jogging device at a predetermined position in the jogging device according to the size of the received sheet detected in the receiving step, so as to be stacked one upon another at the predetermined position.

16. The method according to Claim 15,

wherein the receiving step includes correcting an advancing direction of the received sheet so as to be at a right angle relative to a longitudinal direction of the sheet folding/pressing device.

17. The method according to Claim 16,

wherein the correcting step includes shifting the received sheet to a reference guide so that the advancing direction of the sheet is corrected by the reference guide so as to be at the right angle relative to the longitudinal direction of the sheet folding/pressing device.

18. The method according to Claim 14,

wherein the receiving and jogging step includes moving a movable device of the jogging device to a predetermined position so that the received sheet conveyed by the folding device is jogged with respect to left and right sides thereof in a direction the received sheet has been conveyed by the folding device, and determining by a controller of the sheet folding and binding apparatus if the movable device has completed its movement to the predetermined position and generating a signal indicating that the movable device has completed its movement to the predetermined position when determined as that the movable device has completed its movement to the predetermined position,

wherein the controlling step includes controlling the image forming apparatus to start an image forming operation for a next sheet after the image formation controller receives from the controller of the sheet folding and binding apparatus the signal indicating that the movable device of the jogging device has completed its movement to the predetermined position.

19. The method according to Claim 14, further comprising the steps of:

detecting passage of the received sheet by a detect sensor arranged between the folding device and the jogging device; and

determining as that the received sheet has been jammed and generating a sheet jamming signal indicating that the received sheet has been jammed by a controller of the sheet folding and

binding apparatus if the detecting step is not started within a predetermined period of time after a leading edge of the received sheet has been detected by the sheet size detect device in the receiving step, or when the detecting step has started, if the detecting step is not completed within a predetermined period of time after starting the detecting step.

20. The method according to Claim 19,

wherein the controlling step includes controlling the image forming apparatus by the image formation controller, when controlling the image forming apparatus to perform an image forming operation after receiving from the controller of the sheet folding and binding apparatus the sheet jamming signal indicating that the received sheet has been jammed, to control the image forming apparatus to perform the image forming operation starting with images of pages of the document file formed immediately before.

21. The method according to Claim 14, further comprising the step of:

determining whether or not the folding device, the jogging device and the binding device are respective states ready for receiving a next sheet, and generating a signal indicating that the folding device, the jogging device and the binding device are in the respective states ready for receiving the next sheet when determined as that the folding device, the jogging device and the binding device are respective states ready for receiving

the next sheet and a sheet jamming signal indicating that the received sheet has been jammed when determined as that the folding device, the jogging device and the binding device are not in the respective states ready for receiving the next sheet, by a controller of the sheet folding and binding apparatus; and

wherein the controlling step includes controlling the image forming apparatus by the image formation controller, when the image forming apparatus is in a state ready for starting an image forming operation, to start the image forming operation, upon receiving from the controller of the sheet folding and binding apparatus the signal indicating that the folding device, the jogging device and the binding device are in the respective states ready for receiving the next sheet.

22. The method according to Claim 21,

wherein the controlling step includes controlling the image forming apparatus by the image formation controller, when controlling the image forming apparatus to perform an image forming operation after receiving from the controller of the sheet folding and binding apparatus the sheet jamming signal indicating that the received sheet has been jammed, to perform the image forming operation starting with images of pages of the document file formed immediately before.

23. The method according to Claim 14,

wherein the controlling step includes controlling the image forming apparatus to form the images of the document file

on both sides of the full-size sheet and the half-size sheet that are fed by the sheet feeding device so as to be mixed with each other.

24. The method according to Claim 23,

wherein the controlling step includes controlling the image forming apparatus to form images of given two pages of the document file on each of a given number of the half-size sheets fed by the sheet feeding device so as to be mixed with the full-size sheet.

25. The method according to Claim 14,

wherein the controlling step includes setting a direction of forming the images of four pages of the document file on each full-size sheet to be lateral and a direction of forming the images of two pages of the document file on each half-size sheet to be vertical, and setting upper, bottom, left and right side margins to the half-size sheet and bottom, left and right side margins and a center margin to the full-size sheet.

26. The method according to Claim 14,

wherein the controlling step includes controlling the image forming apparatus to form the images of four pages of the document file on each full-size sheet such that in order of forming the images at the image forming apparatus, an image of a fourth page of the four pages and an image of a first page of the four pages are on an upper side and an image of a second

page of the four pages and an image of a third page of the four pages are on a back side of the full-size sheet, and to form the images of two pages of the document file on each half-size sheet such that in order of forming the images at the image forming apparatus an image of a first page of the two pages is on an upper side and an image of a second page of the two pages is on a back side of the half-size sheet.

27. A method of producing a booklet of a document file, comprising the steps of:

forming images of the document file on both sides of a sheet by an image forming apparatus and discharging the sheet therefrom, the sheet is being selected from a full-size sheet set to be conveyed in its longitudinal direction and a half-size sheet half a size of the full-size sheet and set to be conveyed in its lateral direction;

receiving the sheet discharged from the image forming apparatus, detecting if the received sheet is the full-size sheet conveyed in its longitudinal direction or the half-size sheet half conveyed in its lateral direction, and further conveying the received sheet;

folding the received sheet in two at its center portion in a direction the received sheet is conveyed when the received sheet has been detected to be the full-size sheet in the receiving step and further conveying the folded received sheet with the folded center portion thereof being served as a leading edge of the folded received sheet, and conveying the received

sheet without folding the received sheet when the received sheet has been detected to be the half-size sheet in the receiving step;

receiving and jogging the received sheet, conveyed one after another, to be stacked one upon another;

binding the stacked received sheets at their leading edge portions in a direction the received sheets have been conveyed; and

discharging the bound received sheets as the booklet.

28. A sheet folding and binding apparatus, comprising:

a sheet receiving device configured to receive a sheet carrying images on both sides thereof, discharged from an image forming apparatus, and to further convey the received sheet, the sheet receiving device including a sheet size detect device configured to detect if the received sheet has a predetermined length in a direction the received sheet is conveyed;

a folding device configured to fold the received sheet conveyed by the sheet receiving device in two at its center portion in the direction the received sheet is conveyed by the sheet receiving device, when the received sheet has been detected by the sheet size detect device of the sheet receiving device to have the predetermined length in the direction the received sheet is conveyed by the sheet receiving device, and to further convey the folded received sheet with the folded center portion thereof being served as a leading edge of the folded received sheet;

a directly conveying device configured to guide the received sheet conveyed by the sheet receiving device so as to be further conveyed by the folding device without being folded by the folding device, when the received sheet has been detected by the sheet size detect device of the sheet receiving device not to have the predetermined length in the direction the received sheet is conveyed by the sheet receiving device;

a jogging device configured to receive and jog the received sheet conveyed by the folding device, one after another, so as to be stacked one upon another; and

a binding device configured to bind the stacked received sheets at their leading edge portions in a direction the received sheets is conveyed by the folding device.

29. The sheet folding and binding apparatus according to Claim 28,

wherein the directly conveying device is an integral part of the folding device.

30. The sheet folding and binding apparatus according to Claim 29,

wherein the folding device includes a guiding mechanism configured to receive and guide the received sheet conveyed by the sheet receiving device, and a sheet folding/pressing device configured to pinch the received sheet at its center portion in the direction the received sheet is conveyed by the sheet receiving device so that the received sheet is folded at its

center portion when the received sheet has been detected by the sheet size detect device of the sheet receiving device to have the predetermined length in the direction the received sheet is conveyed by the sheet receiving device and to further convey the folded received sheet with the folded center portion thereof being served as a leading edge of the folded received sheet, and

wherein the directly conveying device is an integral part of the guiding mechanism of the folding device.

31. The sheet folding and binding apparatus according to Claim 30,

wherein the directly guiding device in the guiding mechanism of the folding device includes a returning device configured to return the received sheet conveyed by the sheet receiving device so as to be conveyed by the sheet folding/pressing device, without being folded by the sheet folding/pressing device, to the jogging device, when the received sheet has been detected by the sheet size detect device of the sheet receiving device not to have the predetermined length in the direction the received sheet is conveyed by the sheet receiving device.

32. The sheet folding and binding apparatus according to Claim 29,

wherein the folding device includes a sheet pushing mechanism configured to push the received sheet downward at its

center portion in the direction the received sheet is conveyed by the sheet receiving device when the received sheet has been detected by the sheet size detect device to be the full-size sheet conveyed in its longitudinal direction, and a sheet folding/pressing device configured to pinch the received sheet at the center portion thereof pushed by the sheet pushing mechanism so that the received sheet is folded at the center portion thereof by the sheet folding/pressing device to be further conveyed with the folded center portion thereof being served as the leading edge of the folded received sheet, and wherein the directly conveying device is an integral part of the sheet pushing mechanism of the folding device.

33. The sheet folding and binding apparatus according to Claim 30,

wherein the sheet receiving device includes a correcting mechanism configured to correct an advancing direction of the received sheet so as to be at a right angle relative to the sheet folding/pressing device.

34. The sheet folding and binding apparatus according to Claim 33,

wherein the correcting mechanism of the sheet receiving device of the sheet folding and binding apparatus includes a reference guide configured to guide the advancing direction of the received sheet to be at the right angle relative to the longitudinal direction of the sheet folding/pressing device,

and a sheet shifting device configured to shift the received sheet, while conveying the received sheet, to the reference guide so that the advancing direction of the received sheet is corrected by the reference guide so as to be at the right angle relative to the longitudinal direction of the sheet folding/pressing device.

35. The sheet folding and binding apparatus according to Claim 28, further comprising:

a detect sensor arranged between the folding device and the jogging device to detect the received sheet; and

a controller configured to determine that the received sheet has been jammed and to generate a sheet jamming signal indicating that the received sheet has been jammed when the received sheet has not been detected by the detect sensor in a predetermined period of time after a leading edge of the received sheet has been detected by the sheet size detect sensor or when the received sheet continues to be detected by the detect sensor more than a predetermined period of time.